

CHAPTER – 8

EMERGING TECHNOLOGIES

1. GRID COMPUTING:

Grid computing is a network of computing or processor machines managed with a kind of software such as middleware, in order to access and use the resources remotely.

The idea of Grid computing is to make use of such non-utilized computing power by the needy organizations, and thereby the Return On Investment (ROI) on computing investments can be increased.

Grid Computing is more popular due to the following reasons:

- *It has the ability to make use of unused computing power, and thus, it is a cost- effective solution (reducing investments, only recurring costs).*
- *This enables heterogeneous resources of computers to work cooperatively and collaboratively to solve a scientific problem.*

Grid computing requires the use of software that can divide and carve out pieces of a program as one large system image to several thousand computers.

One concern about grid is that if one piece of the software on a node fails, other pieces of the software on other nodes may fail (as shown in Fig. 8.2.1).

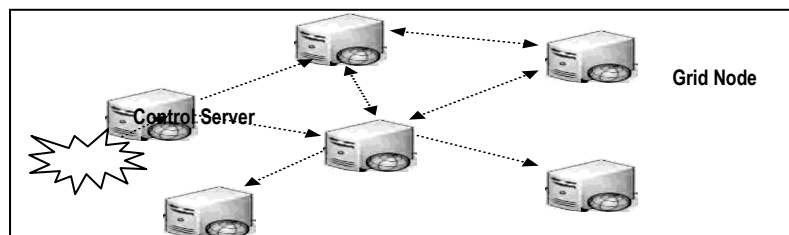


Fig. 8.2.1: Grid Computing Scenario

2. CLOUD COMPUTING:

- **INTERNET** - Cloud computing, simply means the use of computing resources as a service through networks, typically the Internet. The Internet is commonly visualized as clouds, Hence computation done through internet is known as cloud computing.
- **EXAMPLE** - *Google Apps* where any application can be accessed using a browser.
- **COMBINATION** - Cloud computing is both, a combination of software and hardware based computing resources delivered as a networked service.
- **ACCESS** - With Cloud Computing, users can access database resources via the Internet from anywhere and at any time / enables anytime access to a shared pool of applications and resources.
- **SCALE UP** - With cloud computing, companies can scale up to massive capacities in an instant without having to invest in new infrastructure, train new personnel or license new software.
- **PRINCIPLE** - service consumers use '*what they need on the Internet*' and '*pay only for what they use*'.

3. CLOUD VS GRID:

- Cloud computing evolved from grid computing, Grid computing may or may not be in the cloud paradigm depending on what type of users are using it.
- If the users are systems administrators and integrators, they care 'how things are maintained in the cloud, If the users are consumers, they do not care 'how things are run in the system'.
- Grid computing requires the use of software that can divide and carve out pieces of a program as one large system image to several thousand computers.
- One concern about grid is that if one piece of the software on a node fails, other pieces of the software on other nodes may fail.

SOME PERTINENT SIMILARITIES:

- **SCALABLE** - Cloud computing and grid computing both are scalable. Scalability is accomplished through load balancing of application.
- **MULTITASKING** - Both computing types involve multi-tenancy and multitasking, meaning that many customers can perform different tasks, accessing a single or multiple application instances.

SOME PERTINENT DIFFERENCES:

- **STORAGE** - storage computing in the grid is well suited for data-intensive storage, it is not economically suited for storing objects as small as 1 byte BUT While in cloud computing, we can store an object as low as 1 byte and as large as 5 GB or even several terabytes.
- **FOCUS** - A computational grid focuses on computationally intensive operations, while cloud computing offers two types of instances: standard and high-CPU.

4. CHARACTERISTICS OF CLOUD COMPUTING:

- **Performance:** It is monitored and consistent and loosely coupled architectures are constructed using web services as the system interface.
- **Maintenance:** The cloud computing applications are easier, because they are not to be installed on each user's computer and can be accessed from different places.
- **Multi-sharing:** With the cloud working in a distributed and shared mode, multiple users and applications can work more efficiently with cost reductions by sharing common infrastructure.
- **High Scalability:** Cloud environments enable servicing of business requirements for larger audiences, through high scalability.
- **Services in Pay-Per-Use Mode:** SLAs between the provider and the user must be defined when offering services in pay per use mode.
- **High Availability and Reliability:** Availability of servers is supposed to be high and more reliable as the chances of infrastructure failure are minimal.
- **Agility:** The cloud works in the 'distributed mode' environment. It shares resources among users and tasks, while improving efficiency and agility (responsiveness).
- **Virtualization:** This technology allows servers and storage devices to increasingly share and utilize applications, by easy migration from one physical server to another.

5. ADVANTAGES OF CLOUD COMPUTING:

- **COST EFFICIENCY:** Cloud computing is probably the most cost efficient method to use, maintain and upgrade. Traditional desktop software costs companies a lot in terms of finance. The cloud, on the other hand, is available at much cheaper rates and hence, can significantly lower the company's IT expenses.
- **UNLIMITED STORAGE:** Storing information in the cloud gives us almost unlimited storage capacity. Hence, one no more need to worry about running out of storage space or increasing the current storage space availability.
- **BACKUP AND RECOVERY:** Since all the data is stored in the cloud, backing it up and restoring the same is relatively much easier than storing the same on a physical device.
- **EASY ACCESS TO INFORMATION:** Once registered in the cloud, one can access the information from anywhere, where there is an Internet connection. This convenient feature lets one move beyond time zone and geographic location issues.
- **AUTOMATIC SOFTWARE INTEGRATION:** In the cloud, software integration is usually something that occurs automatically. This means that we do not need to take additional efforts to customize and integrate the applications as per our preferences. This aspect usually takes care of itself.
- **QUICK DEPLOYMENT:** Lastly and most importantly, cloud computing gives us the advantage of quick deployment i.e. the entire system can be fully functional in a matter of a few minutes.

6. GOALS OF CLOUD COMPUTING:

- **C** -To create a highly efficient IT ecosystem, where resources are pooled together and costs are aligned with what resources are actually used;
- **A** -To access services and data from anywhere at any time;
- **R** -To reduce costs related to IT energy/power consumption
- **C** -To consolidate IT infrastructure into a more integrated and manageable environment
- **E** -To enable or improve "Anywhere Access" (AA) for ever increasing users; and
- **E** -To enable rapidly provision resources as needed.
- **S** -To scale the IT ecosystem quickly, easily and cost-effectively based on the evolving business needs;

7. ISSUES RELATING TO CLOUD COMPUTING:

A. Security Issues:

- **Integrity:** Integrity refers to the prevention of unauthorized modification of data and it ensures that data is of high quality, correct, consistent and accessible..It should be insured that the data is not changed after being moved to the cloud.
- **Confidentiality:** Prevention of the unauthorized disclosure of the data is referred as Confidentiality. Normally, Cloud works on public networks; therefore, there is a requirement to keep the data confidential the unauthorized entities.
- **Availability:** Availability refers to the prevention of unauthorized withholding of data and it ensures the data backup through Business Planning Continuity Planning (BCP) and Disaster Recovery Planning (DRP).
- **Governance:** Due to the lack of control over the employees and services, it creates problems relating to design, implementation, testing and deployment. So, there is a need of governance model, which controls the standards, procedures and policies of the organization
- **Trust:** Trust is an important issue in Cloud. Various clients' oriented studies reveal that Cloud has still failed to build trust between the client and service provider.
- **Legal Issues and Compliance:** There are various requirements relating to legal, privacy and data security laws that need to be studied in Cloud system. One of the major troubles with laws is that they vary from place to place. There is a need to understand various types of laws and regulations that impose security and privacy duties on the organization.
- **Privacy:** Privacy is also considered as one of the important issues in Cloud. The privacy issues are embedded in each phase of the Cloud design. The Cloud should be designed in such a way that it decreases the privacy risk.
- **Audit:** Auditing is type of checking that 'what is happening in the Cloud environment'.
- **Data Stealing:** In a Cloud, data stored anywhere is accessible in public form and private form by anyone at any time. In such cases, an issue arises as data stealing. Some of the Cloud providers do not use their own server, instead. They use server/s from other service providers. In that case, there is a probability that the data is less secure and is more prone to the loss from external server.
- **Architecture:** In the architecture of Cloud computing models, there should be a control over the security and privacy of the system.
- **Identity Management and Access control:** The identity management provides a trust and shares the digital attributes between the Cloud provider and organization ensuring the protection against attackers.
- **Software Isolation:** Software isolation is to understand virtualization and other logical isolation techniques
- **Application Security:** Security issues relating to application security still apply when applications move to a cloud platform. Infected applications need to be monitored.
- **Incident Response:** It ensures to meet the requirements of the organization during an incident. It ensures that the Cloud provider has sufficient mechanisms to share information during and after an incident.

B. Implementation/Adaptation Issues:

- **Threshold Policy:** This involves the checking how the policy enables to detect sudden increases in the demand and results in the creation of additional instances to fill in the demand. Moreover, to determine how unused resources are to be de-allocated and turned over to other work needs to work out in the context. That is working out thresholds is really a matter of concern and would go a long way to assure the effectiveness.
- **Environment Friendly Cloud Computing:** One incentive for cloud computing is that it may be more environment friendly. First, reducing the number of hardware components needed to run applications on the company's internal data centre & second it reduces energy for running and cooling hardware.
- **Security issues:** Instead of waiting for an outage to occur, consumers should do security testing on their own checking how well a vendor can recover data. Apart from the common testing practices, what one needs primarily to do is to ask for old stored data and check how long it takes for the vendor to recover.
- **Unexpected Behavior:** It is important to test the application in the cloud with a pilot study to check for unexpected behavior. . If the tests show unexpected results, we will need to fix the problem before executing or obtaining cloud services from the cloud.
- **Software Development in Cloud:** To develop software using high-end databases, the most likely choice is to use cloud server pools at the internal data corporate centre and extend resources temporarily for testing purposes.

- **Hidden Costs:** Many times cloud computing service providers do not reveal ‘what hidden costs are’. For instance, companies could incur higher network charges from their service providers for storage and database applications containing terabytes of data in the cloud. This outweighs costs they could save on new infrastructure, training new personnel, or licensing new software
- **Interoperability:** If a company outsources or creates applications with one cloud computing vendor, the company may find it difficult to change to another computing vendor that has proprietary Application Programming Interfaces (APIs) and different formats for importing and exporting data.

8. CLOUD COMPUTING ARCHITECTURE:

- The Cloud Computing Architecture is the **structure of the system**, which comprises of resources, services, middleware, and software components,
- Cloud architecture **typically involves** into multiple cloud components communicating with each other over a loose coupling mechanism, such as a messaging queue.
- In the context of cloud computing, protection depends on having the Right Architecture for the Right Application (**RARA**).
- **Organizations must understand** the individual requirements of their applications, and if already using a cloud platform, understand the corresponding cloud architecture.
- A cloud computing architecture consists of a **Front End** and a **Back End**. They connect to each other through a network, usually the Internet.
- The **front end** is the side, the computer user sees and interacts through, and the **back end** is the “cloud” section of the system, truly facilitating the services.

The details are given as follow:

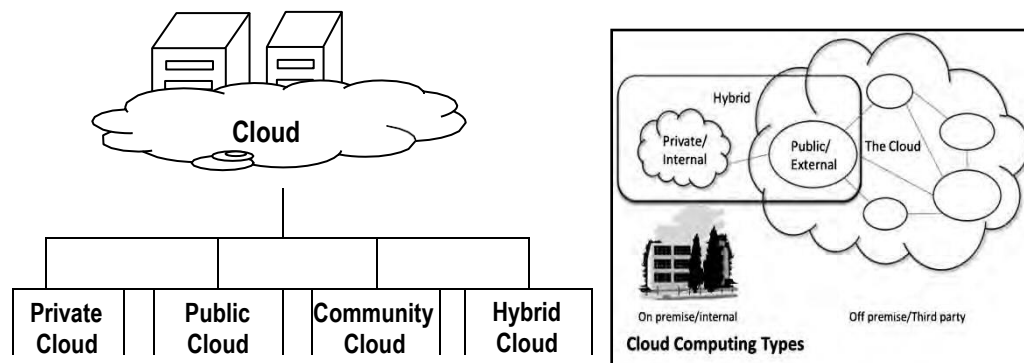
Front End Architecture: The front end of the cloud computing system comprises of the client’s devices/computer network/some applications needed for accessing the cloud computing system.

Back End Architecture: Back end refers to some service facilitating peripherals. In cloud computing, the back end is cloud itself, which may encompass various computer machines, data storage systems and servers..

A central server is established to be used for administering the whole system. It is also used for monitoring client’s demand as well as traffic to ensure that everything of system runs without any problem. There are some set of rules, technically referred as protocols, are followed by this server and it uses a special type of software known as middleware.

9. CLOUD COMPUTING ENVIRONMENT:

The Cloud Computing environment can consist of multiple types of clouds based on their deployment and usage. Such typical Cloud computing environments, catering to special requirements, are briefly described as follows



(a) Private Cloud:

- These are also called Internal Clouds or Corporate Clouds.
- Resides within the boundaries of an organization.
- Used exclusively for the organization’s benefits.
- Built by IT department within the enterprise.

Private Clouds can either be private to the organization and managed by the single organization (On-Premise Private Cloud) or can be managed by third party (Outsourced Private Cloud).

Certain characteristics of Private Cloud are as follows:

- **Secure:** The private cloud is secure as it is deployed and managed by the organization itself, and hence there is least chance of data being leaked out of the cloud.
- **Central Control:** As usual, the private cloud is managed by the organization itself, there is no need for the organization to rely on anybody and its controlled by the organization itself.
- **Weak Service Level Agreements (SLAs):** SLAs play a very important role in any cloud service deployment model as they are defined as agreements between the user and the service provider in private cloud. In private cloud, either Formal SLAs do not exist or they are weak, as it is between the organization and user of the same organization. Thus, high availability and good service may or may not be available.

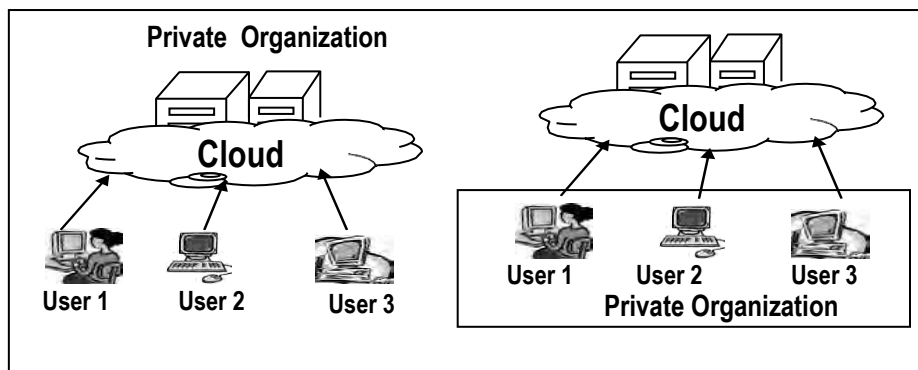
Advantages of Private Cloud:

- It improves average server utilization.
- allow usage of low-cost servers and hardware
- higher efficiencies
- reducing the costs
- It provides a high level of security and privacy to the user.
- It is small in size and controlled and maintained by the organization.

Major Limitation:

- IT teams in the organization may have to invest in buying, building and managing the clouds independently.
- Budget is a constraint in private clouds and they also have loose SLAs.

However, the major differences between On-Premise Private Cloud and Outsourced Private Cloud are given in Table



	On-Premise Private Cloud	Outsourced Private Cloud
Management	Managed by the organization itself.	Managed by the third party. Everything is same as usual private cloud except that here the cloud is outsourced.
Service Level Agreements (SLAs)	SLAs are defined between the organization and its users. Users have broader access rights than general public cloud users and service providers are able to efficiently provide the service because of small user base and mostly efficient network.	These are usually followed strictly as it is a third party organization.
Network	Network management and network issue resolving are easier. The networks usually have high bandwidth and low latency.	The cloud is fully deployed at the third party site and organizations connect to the third party by means of either a dedicated connection or through Internet.
Security and Data Privacy	Comparatively, it is more resistant to attacks than any other cloud and the security attacks are possible from an internal user only.	Cloud is relatively less secure and the security threat is from the third party and the internal employee.
Location	The data is usually stored in the same geographical location where the cloud users are present. In case of several physical locations, the cloud is distributed over several places and is accessed using the Internet.	The cloud is located off site and when there is a change of location the data need to be transmitted through long distances.
Performance	The performance depends on the network and resources and can be controlled by the network management team.	The performance of the cloud depends on the third party that is outsourcing the cloud.

(b) Public Cloud:

- Open use by the general public.
- It may be owned, managed, and operated by a business, academic, or government organizations, or some combination of them.
- Typically, public clouds are administrated by third parties or vendors over the Internet, and the services are offered on pay-per-use basis.
- These are also called Provider Clouds.

Public cloud consists of users from all over the world wherein a user can simply purchase resources on an hourly basis and work with the resources which are available in the cloud provider's premises.

Characteristics of Public Cloud are as follows:

- **Highly Scalable:** The resources in the public cloud are large in number and the service providers make sure that all requests are granted. Hence public clouds are considered to be scalable.
- **Affordable:** The cloud is offered to the public on a pay-as-you-go basis; hence the user has to pay only for what he or she is using (using on a per-hour basis). And this does not involve any cost related to the deployment.
- **Less Secure:** Since it is offered by a third party and they have full control over the cloud, the public cloud is less secure out of all the other deployment models.
- **Highly Available:** It is highly available because anybody from any part of the world can access the public cloud with proper permission, and this is not possible in other models as geographical or other access restrictions might bethere.
- **Stringent SLAs:** As the service provider's business reputation and customer strength are totally dependent on the cloud services, they follow the SLAs strictly and violations are avoided.

Advantages of Public Cloud:

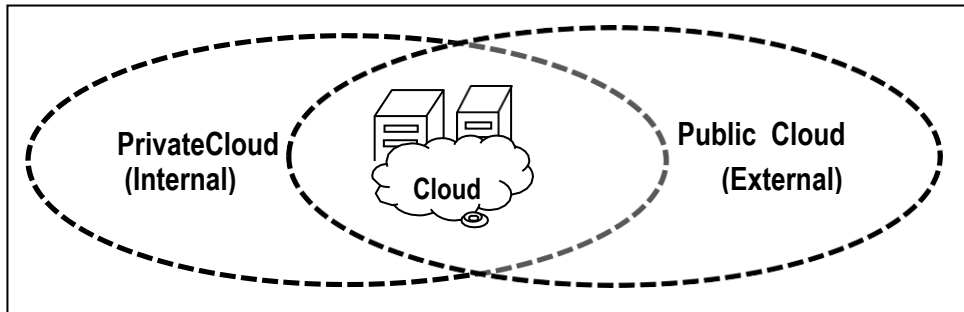
- It is widely used in the development, deployment and management of enterprise applications, at affordable costs.
- It allows the organizations to deliver highly scalable and reliable applications rapidly and at more affordable costs.
- There is no need for establishing infrastructure for setting up and maintaining the cloud.
- Strict SLAs are followed.
- There is no limit for the number of users.

Major Limitation:

- Moreover, one of the limitations is **security assurance** and thereby building **trust** among the clients is far from desired but slowly liable to happen.
- Further, privacy and organizational autonomy are not possible

(c) Hybrid Cloud:

- This is a combination of both at least one private (internal) and at least one public (external) cloud computing environments
- The usual method of using the hybrid cloud is to have a private cloud initially, and then for additional resources, the public cloud is used.
- The hybrid cloud can be regarded as a private cloud extended to the public cloud and aims at utilizing the power of the public cloud by retaining the properties of the private cloud.
- It is typically offered in either of two ways. A vendor has a private cloud and forms a partnership with a public cloud provider or a public cloud provider forms a partnership/franchise with a vendor that provides private cloud platforms.



Characteristics of Hybrid Cloud are as follows:

- **Scalable:** The hybrid cloud has the property of public cloud with a private cloud environment and as the public cloud is scalable; the hybrid cloud with the help of its public counterpart is also scalable.
- **Partially Secure:** The private cloud is considered as secured and public cloud has high risk of security breach. The hybrid cloud thus cannot be fully termed as secure but as partially secure.
- **Stringent SLAs:** Overall the SLAs are more stringent than the private cloud and might be as per the public cloud service providers.
- **Complex Cloud Management:** Cloud management is complex as it involves more than one type of deployment models and also the number of users is high.

Advantages of Hybrid Cloud

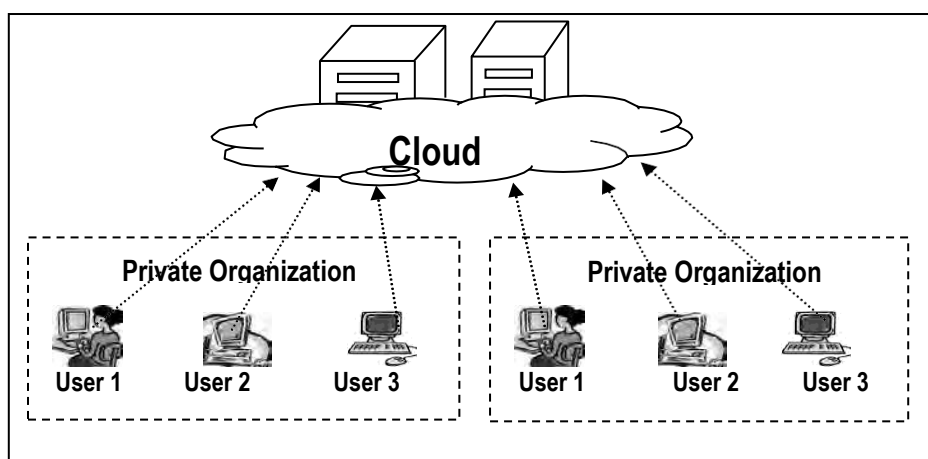
- It is highly scalable and gives the power of both private and public clouds.
- It provides better security than the public cloud.

Major Limitation:

The security features are not as good as the public cloud and complex to manage.

(d) **Community Cloud:**

- The community cloud is the cloud infrastructure that is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (eg. Mission security requirements, policy, and compliance considerations).
- It may be owned, managed, and operated by one or more of the organizations in the community, a third party or some combination of them, and it may exist on or off premises.
- This model is suitable for organizations that cannot afford a private cloud and cannot rely on the public cloud either.



Characteristics of Community Clouds are as follows:

Collaborative and Distributive Maintenance: In this, no single company has full control over the whole cloud. This is usually distributive and hence better cooperation provides better results.

Partially Secure: This refers to the property of the community cloud where few organizations share the cloud, so there is a possibility that the data can be leaked from one organization to another, though it is safe from the external world.

Cost Effective: As the complete cloud is being shared by several organizations or community, not only the responsibility gets shared; the community cloud becomes cost effective too.

Advantages of Community Clouds:

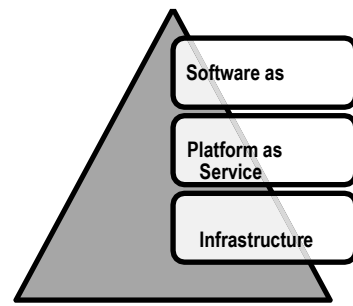
- It allows establishing a low-cost private cloud.
- It allows collaborative work on the cloud.
- It allows sharing of responsibilities among the organizations.
- It has better security than the public cloud.

Major Limitation:

- The limitation of the community cloud is that the autonomy of the organization is lost and some of the security features are not as good as the private cloud.
- It is not suitable in the cases where there is no collaboration.

10. CLOUD COMPUTING MODELS:

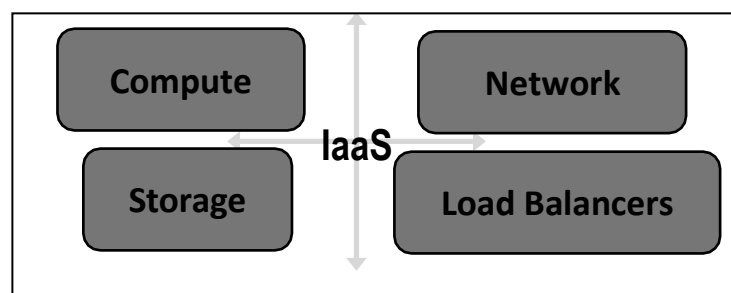
Cloud computing is a model that enables the end users to access the shared pool of resources such as computer, network, storage, database and application as an on- demand service without the need to buy or own it.



(a) Infrastructure as a Service (IaaS):

- IaaS, a hardware-level service, provides computing resources such as processing power, memory, storage, and networks for cloud users to run their application on-demand.
- This allows users to maximize the utilization of computing capacities without having to own and manage their own resources.
- IaaS changes the computing from a physical infrastructure to a virtual infrastructure through virtual computing; storage; and network resources by abstracting the physical resources.
- IaaS providers offer computers, more often virtual machines and other resources as service; the infrastructure / storage required to host the services ourselves i.e. makes us the system administrator and manage hardware/storage, network and computing resources. .

Examples of IaaS providers include Amazon Web Services (AWS), Google Compute Engine, Open Stack and Eucalyptus.



A typical IaaS provider may provide the following services:

- Compute:** Computing as a Service includes virtual Central Processing Inputs (CPUs) and virtual main memory for the Virtual Machines (VMs) that are provisioned to the end users.
- Storage:** STaaS provides back-end storage for the VM images. Some of the IaaS providers also provide the back end for storing files.
- Network:** Network as a Service (NaaS) provides virtual networking components such as virtual router, switch, and bridge for the VMs.
- Load Balancers:** Load balancing as a Service may provide load balancing capability at the infrastructure layer.

Characteristics of IaaS are as follows:

Web access to the resources: The IaaS model enables the IT users to access infrastructure resources over the Internet. When accessing a huge computing power, the IT user need not get physical access to the servers.

Centralized management: The resources distributed across different parts are controlled from any management console that ensures effective resource management and effective resource utilization.

Elasticity and Dynamic Scaling: Depending on the load, IaaS services can provide the resources and elastic services where the usage of resources can be increased or decreased according to the requirements.

Shared infrastructure: IaaS follows a one-to-many delivery model and allows multiple IT users to share the same physical infrastructure and thus ensure high resource utilization.

Metered Services: IaaS allows the IT users to rent the computing resources instead of buying it. The services consumed by the IT user will be measured, and the users will be charged by the IaaS providers based on the amount of usage.

The different instances of IaaS are as follows:

➤ Network as a Service (NaaS):

NaaS, an instance of IaaS, provides users with needed data communication capacity during data-intensive activities such as video conferencing or large file downloads.

It is an ability given to the end-users to access **virtual network services** that are provided by the service provider over the Internet on pay-per-use basis.

NaaS allows network architects to create virtual networks; virtual network interface cards (NICs), virtual routers, virtual switches, and other networking components.

NaaS providers operate using three common service models: Virtual Private Network (VPN), Bandwidth on Demand (BoD) and Mobile Virtual Network (MVN).

➤ Storage as a Service (STaaS):

STaaS, an instance of IaaS, provides **storage infrastructure** on a subscription basis to users who want a low-cost and convenient way to store data, synchronize data across multiple devices, manage off-site backups, mitigate risks of disaster recovery, and preserve records for the long-term.

It is an ability given to the end users to store the data on the storage services provided by the service provider.

STaaS allows the end users to access the files at any time from any place.

➤ Database as a Service (DBaaS):

This is also related to IaaS and provides users with seamless mechanisms to **create, store, and access databases** at a host site on demand. It is an ability given to the end users to access the database service without the need to install and maintain it on the pay-per-use basis. The end users can access the database services through any Application Programming Interfaces (APIs) or Web User Interfaces provided by the service provider.

➤ Backend as a Service (BaaS):

It is a type of IaaS, that provides web and mobile app developers a way to connect their applications to backend cloud storage with added services such as user management, push notifications, social network services integration using custom software development kits and application programming interfaces.

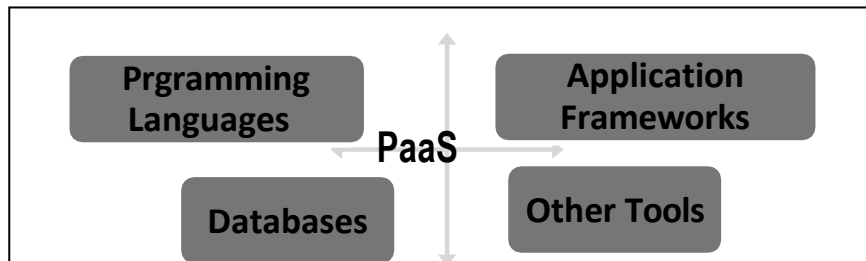
➤ **Desktop as a Service (DTaaS):**

It is an instance of IaaS that provides ability to the end users to use desktop virtualization without buying and managing their own infrastructure. DTaaS is a pay-per-use cloud service delivery model in which the service provider manages the back-end responsibilities of data storage, backup, security and upgrades. The end-users are responsible for securing and managing their own desktop images, applications, and security. These services are simple to deploy, are highly secure, and produce better experience on almost all devices.

(b) Platform as a Service (PaaS):

PaaS provides the users the ability to **develop and deploy an application**. In traditional application development, the application will be developed locally and will be hosted in the central location. In stand-alone application development, the application will be developed by traditional development platforms result in licensing - based software, whereas PaaS changes the application development from local machine to online. For example- Google App Engine, Windows Azure Compute etc.

Typical PaaS providers may provide programming languages, application frameworks, databases, and testing tools apart from some build tools, deployment tools and software load balancers as a service in some cases



- **Programming Languages:** PaaS providers provide a wide variety of programming languages like Java, PHP, Python, Ruby etc. for the developers to develop applications.
- **Application Frameworks:** PaaS vendors provide application development framework like Joomla, WordPress, Sinatra etc. for application development.
- **Database:** Along with PaaS platforms, PaaS providers provide some of the popular databases like ClearDB, Cloudant, Redis etc. so that application can communicate with the databases.
- **Other Tools:** PaaS providers provide all the tools that are required to develop, test, and deploy an application.

Characteristics of PaaS are as follows:

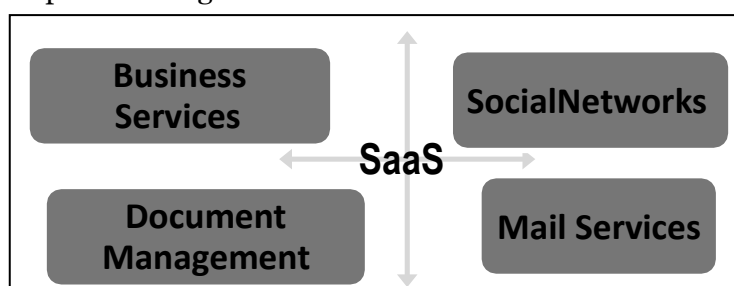
- **All in One:** Most of the PaaS providers offer services like programming languages to develop, test, deploy, host and maintain applications in the same Integrated Development Environment.
- **Web access to the development platform:** PaaS provides web access to the development platform that helps the developers to create, modify, test, and deploy different applications on the same platform.
- **Offline Access:** To enable offline development, some of the PaaS providers allow the developer to synchronize their local IDE with the PaaS services. The developers can develop an application locally and deploy it online whenever they are connected to the Internet.
- **Built-in Scalability:** PaaS services provide built-in scalability to an application that is developed using any particular PaaS. This ensures that the application is capable of handling varying loads efficiently.
- **Collaborative Platform:** To enable collaboration among developers, most of the PaaS providers provide tools for project planning and communication.
- **Diverse Client Tools:** PaaS providers offer a wide variety of client tools like Web User Interface (UI), Application Programming Interface (API) etc. to help the developers to choose the tool of their choice.

(c) Software as a Service (SaaS):

SaaS provides ability to the end users to access an application over the Internet that is hosted and managed by the service provider. Thus, the end users are exempted from managing or controlling an application and the underlying infrastructure. SaaS changes the way the software is delivered to the customers.

In the traditional software model, the software is delivered as a license-based product that needs to be installed in the end user device. Since SaaS is delivered as an on-demand service over the Internet, there is no need to install the software to the end-user's devices. SaaS services can be accessed or disconnected at any time based on the end user's needs.

SaaS provides users to access large variety of applications over internet that are hosted on service provider's infrastructure. For example, one can make his/her own word document in Google docs online, s/he can edit a photo online on pixlr.com so s/he need not install the photo editing software on his/her system- thus Google is provisioning software as a service.



The services provided by SaaS are as follows:

- **Business Services:** SaaS providers provide a variety of business services to startup companies that includes ERP, CRM, billing, sales, and human resources.
- **Social Networks:** Since the number of users of the social networking sites is increasing exponentially, cloud computing is the perfect match for handling the variable load.
- **Document Management:** Most of the SaaS providers provide services to create, manage, and track electronic documents as most of the enterprises extensively use electronic documents.
- **Mail Services:** To handle the unpredictable number of users and the load on e-mail services, most of the email providers offer their services as SaaS services.

Characteristics of SaaS are as follows:

- **One to Many:** SaaS services are delivered as one-to-many models where a single instance of the application can be shared by multiple customers.
- **Web Access:** SaaS services allow the end users to access the application from any location of the device is connected to the Internet.
- **Centralized Management:** Since SaaS services are hosted and managed from the central location, the SaaS providers perform the automatic updates to ensure that each customer is accessing the most recent version of the application without any user-side updates.
- **Multi-device Support:** SaaS services can be accessed from any end user devices such as desktops, laptops, tablets, smartphones, and thin clients.
- **Better Scalability:** Most of the SaaS services leverage PaaS and IaaS for its development and deployment and ensure a better scalability than traditional software.
- **High Availability:** SaaS services ensure 99.99% availability of user data as proper backup and recovery mechanisms are implemented.
- **API Integration:** SaaS services have the capability of integrating with other software or service through standard APIs.

The different instances of SaaS are as follows:

Testing as a Service (TaaS): This provides users with software testing capabilities such as generation of test data, generation of test cases, execution of test cases and test result evaluation on a pay-per-use basis.

API as a Service (APIaaS): This allows users to explore functionality of Web services such as Google Maps, Payroll processing, and credit card processing services etc.

Email as a Service (EaaS): This provides users with an integrated system of emailing, office automation, records management, migration, and integration services with archiving, spam blocking, malware protection, and compliance features.

(d) Other Cloud Service Models:

➤ **Communication as a Service (CaaS):**

CaaS has evolved in the same lines as SaaS. CaaS is an outsourced enterprise communication solution (OECS) that can be leased from a single vendor. The CaaS vendor is responsible for all hardware and software management and offers guaranteed Quality of Service (QoS). It allows businesses to selectively deploy communication devices and modes on a pay-as-you-go, as-needed basis. This approach eliminates the large capital investments. Examples are: Voice over IP (VoIP), Instant Messaging (IM), Collaboration and Videoconferencing application using fixed and mobile devices.

➤ **Data as a Service (DaaS):**

DaaS provides data on demand to a diverse set of users, systems or application. The data may include text, images, sounds, and videos. DaaS users have access to high-quality data in a centralized place and pay by volume or data type, as needed. However, as the data is owned by the providers, users can only perform read operations on the data. DaaS is highly used in geography data services and financial data services.

➤ **Security as a Service (SECaaS):**

It is an ability given to the end user to access the security service provided by the service provider on a pay-per-use basis. It is a new approach to security in which cloud security is moved into the cloud itself whereby cloud service users will be protected from within the cloud using a unified approach to threats.

➤ **Identity as a Service (IDaaS):**

It is an ability given to the end users; typically an organization or enterprise; to access the authentication infrastructure that is built, hosted, managed and provided by the third party service provider. Generally, IDaaS includes directory services, authentication services, risk and event monitoring, single sign-on services, and identity and profile management.

11. MOBILE COMPUTING

- Under traditional computing-fixed physical line
- Mobile computing emerged as a solution
- Refers to the technology that allows **Transmission of data** via a computer without having to be connected to a fixed physical link. Mobile voice communication is widely established throughout the world and has had a very rapid increase in the number of subscribers to the various cellular networks over the last few years. An extension of this technology is the ability to send and receive data across these cellular networks. This is the fundamental principle of mobile computing.
- Mobile data communication has become a very important and rapidly evolving technology as it allows users to transmit data from remote locations to other remote or fixed locations. This proves to be the solution of the biggest problem of business people on the move i. e. mobility

Components of Mobile Computing

- **Mobile Communication:** This refers to the **infrastructure** put in place to ensure that seamless and reliable communication goes on. This would include communication properties, protocols, data formats and concrete technologies.
- **Mobile Hardware:** This includes **mobile devices or device components** that receive or access the service of mobility. They would range from Portable laptops, Smart Phones, Tablet PCs, and Personal Digital Assistants (PDA) that use an existing and established network to operate on. At the back end, there are various servers like Application Servers, Database Servers and Servers with wireless support, WAP gateway, a Communications Server. The characteristics of mobile computing hardware are defined by the size and form factor, weight, microprocessor, primary storage, secondary storage, screen size and type, means of input, means of output, battery life, communications capabilities, expandability and durability of the device.
- **Mobile Software:** Mobile Software is the **actual programme** that runs on the mobile hardware and deals with the characteristics and requirements of mobile applications. It is the **operating system** of that appliance and is the essential component that makes the mobile device operate. Mobile applications popularly called Apps are being developed by organizations for use by customers but these apps could represent risks, in terms of flow of data as well as personal identification risks, introduction of malware and access to personal information of mobile owner.

How Mobile Computing Works?

Here is how Mobile Computing works:

- The user enters or access data using the application on handheld computing device.
- Using one of several connecting technologies, the new data are transmitted from handheld to site's information system where files are updated and the new data are accessible to other system user.
- Now both systems (handheld and site's computer) have the same information and are in sync.
- The process work the same way starting from the other direction.

The process is similar to the way a worker's desktop PC access the organization's applications, except that user's device is not physically connected to the organization's system. The communication between the user device and site's information systems uses different methods for transferring and synchronizing data, some involving the use of Radio Frequency (RF) technology

Benefits of Mobile Computing

- Facilitates access to corporate services and information at any time, from anywhere.
- Facilitating excellent communication.
- Increases information quality and accessibility
- Improves management effectiveness
- Provides mobile workforce with Remote access to work order details, such as work order location, contact information, required completion date, asset history relevant warranties/service contracts.
- It provides remote access to the corporate Knowledgebase at the job location.
- Enables mobile sales personnel to update work order status in real-time,
- Enables to improve management effectiveness by enhancing information quality, information flow, and ability to control a mobile workforce
- Enhances operational efficiency.

Limitations of Mobile Computing

- **Insufficient Bandwidth:** Mobile Internet access is generally slower than direct cable connections using technologies such as General Packet Radio Service (GPRS) and Enhanced Data for GSM (Global System for Mobile Communication) Evolution (EDGE), and more recently 3G networks. These networks are usually available within range of commercial cell phone towers. Higher speed wireless LANs are inexpensive but have very limited range.
- **Security Standards:** When working mobile, one is dependent on public networks, requiring careful use of Virtual Private Network (VPN). Security is a major concern while concerning the mobile computing standards. One can easily attack the VPN through a huge number of networks interconnected through the line.
- **Power consumption:** When a power outlet or portable generator is not available, mobile computers must rely entirely on battery power. Combined with the compact size of many mobile devices, this often means unusually expensive batteries must be used to obtain the necessary battery life. Mobile computing should also look into Greener IT in such a way that it saves the power or increases the battery life.
- **Transmission interferences:** Weather, terrain, and the range from the nearest signal point can all interfere with signal reception. Reception in tunnels, some buildings, and rural areas is often poor.
- **Potential health hazards:** People who use mobile devices while driving are often distracted from driving and are thus assumed to be more likely involved in traffic accidents. Cell phones may interfere with sensitive medical devices. There are allegations that cell phone signals may cause health problems.
- **Human interface with device:** Screens and keyboards tend to be small, which may make them hard to use. Alternate input methods such as speech or handwriting recognition require retraining.

Issues in Mobile Computing

- **Security Issues:** Wireless networks have relatively more security requirements than wired network. A number of approaches have been suggested and also the use of encryption has been proposed.
 - **Confidentiality:** Preventing unauthorized users from gaining access to critical information of any particular user.
 - **Integrity:** Ensures unauthorized modification, destruction or creation of information cannot take place.
 - **Availability:** Ensuring authorized users getting the access they require.
 - **Legitimate:** Ensuring that only authorized users have access to services.
 - **Accountability:** Ensuring that the users are held responsible for their security related activities by arranging the user and his/her activities are linked if and when necessary.
- **Bandwidth:** Bandwidth utilization can be improved by logging (bulk operations against short requests) and compression of data before transmission. The technique of caching frequently accessed data items can play an important role in reducing contention in narrow bandwidth wireless networks. Since mobile clients often disconnect to conserve battery power the cached data can support disconnected operations.
- **Location Intelligence:** As the mobile computers move, they encounter networks with different features. A mobile computer must be able to switch from infrared mode to radio mode as it moves from indoors to outdoors. Additionally it should be capable of switching from cellular mode of operation to satellite mode as the computer moves from urban and rural areas.
- **Power Consumption:** Mobile Computers will rely on their batteries as the primary power source. Batteries should be ideally as light as possible but at the same time they should be capable of longer operation times. Power consumption should be minimized to increase battery life. Chips can be redesigned to operate at lower voltages. Power management can also help. Individual Components, be powered down when they are idle.
- **Revising the technical architecture:** Mobile users are demanding and are important to the business world. To provide complete connectivity among users; the current communication technology must be revised to incorporate mobile connectivity. Additionally, application and data architectures must also be revised to support the demands put upon them by the mobile connectivity.
- **Reliability, coverage, capacity, and cost:** At present; wireless network is less reliable, have less geographic coverage and reduced bandwidth, are slower, and cost more than the wired-line network services. It is important to find ways to use this new resource more efficiently by designing innovative applications.
- **Integration with legacy mainframe and emerging client/server applications:** Application development paradigms are changing. As a result of the IT industry's original focus on mainframes, a huge inventory of applications using communications interfaces that are basically incompatible with mobile connectivity have been accumulated. Still the application development trend is geared towards wired network.
- **End-to-end design and performance:** Since mobile computing involves multiple networks (including wired) and multiple application server platforms; end-to-end technical compatibility, server capacity design, and network response time estimates are difficult to achieve.
- **Business challenges:** In addition to these technical challenges, mobile computing also faces business challenges. This is due to the lack of trained professionals to bring the mobile technology to the general people and development of pilot projects for testing its capabilities.

12. GREENCOMPUTING:

- Green computing or Green IT refers to the study and practice of environmentally sustainable computing or IT.
- In other words, it is the study and practice of establishing / using computers and IT resources in a more efficient and environmentally friendly and responsible way.
- Computers consume a lot of natural resources, from the raw materials needed to manufacture them, the power used to run them, and the problems of disposing them at the end of their life cycle.
- This can include "designing, manufacturing, using, and disposing of computers, servers and associated subsystems - such as monitors, printers, storage devices, and networking and communications systems - efficiently and effectively with minimal or no impact on the environment".
- The objective of Green computing is to reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote the recyclability or biodegradability of defunct products and factory waste

13. GREEN COMPUTING BEST PRACTICES:

Develop a sustainable Green Computing plan

- *Involve stakeholders to include checklists, recycling policies, recommendations for disposal of used equipment, government guidelines and recommendations for purchasing green computer equipment in organizational policies and plans;*
- Encourage the IT community for using the best practices and encourage them to consider green computing practices and guidelines.
- On-going communication about and campus commitment to green IT best practices to produce notable results.
- *Include power usage, reduction of paper consumption, as well as recommendations for new equipment and recycling old machines in organizational policies and plans; and*
- *Use cloud computing so that multiple organizations share the same computing resources, thus increasing the utilization by making more efficient use of hardware resources.*

Recycle

- Dispose e-waste according to central, state and local regulations;
- Discard used or unwanted electronic equipment in a convenient and environmentally responsible manner as computers emit harmful emissions;
- Manufacturers must offer safe end-of-life management and recycling options when products become unusable; and
- Recycle computers through manufacturer's recycling services.

Make environmentally sound purchase decisions

- Purchase of desktop computers, notebooks and monitors based on environmental attributes;
- Provide a clear, consistent set of performance criteria for the design of products;
- Recognize manufacturer efforts to reduce the environmental impact of products by reducing or eliminating environmentally sensitive materials, designing for longevity and reducing packaging materials; and
- Use Server and storage virtualization that can help to improve resource utilization, reduce energy costs and simplify maintenance.

Reduce Paper Consumption

- Reduce paper consumption by use of e-mail and electronic archiving;
- Use of "track changes" feature in electronic documents, rather than redline corrections on paper;
- Use online marketing rather than paper based marketing; e-mail marketing solutions that are greener, more affordable, flexible and interactive than direct mail; free and low-cost online invoicing solutions that help cut down on paper waste; and
- While printing documents; make sure to use both sides of the paper, recycle regularly, use smaller fonts and margins, and selectively print required pages.

Conserve Energy

- Power-down the CPU and all peripherals during extended periods of inactivity
- Power-up and power-down energy-intensive peripherals such as laser printers according to need;
- Use Liquid Crystal Display (LCD) monitors rather than Cathode Ray Tube (CRT) monitors;
- Use notebook computers rather than desktop computers whenever possible;
- Use the power-management features to turn off hard drives and displays after several minutes of inactivity;
- Employ alternative energy sources for computing workstations, servers, networks and data centers
- Try to do computer-related tasks during contiguous, intensive blocks of time, leaving hardware off at other times
- *Adapt more of Web conferencing offers instead of travelling to meetings in order to go green and save energy.*
- *Develop a thin-client strategy wherein thin clients are smaller, cheaper, simpler for manufacturers to build than traditional PCs or notebooks and most importantly use about half the power of a traditional desktop PC.*

14. GREEN IT SECURITY SERVICES AND CHALLENGES:

- IT solution providers are offering green security services in many ways. What to look in green security products, the challenges in the security services market and how security services fare in a recession.
- If administered properly with other green computing technologies, green security can be a cost-efficient and lucrative green IT service for solution providers.
- The basic aim is to increase the customer's energy savings through green security services and assess that 'how sustainable computing technology can immediately help the environment'.
- Green IT services present many benefits for clients as well as providers, but knowing 'how to evaluate a client's infrastructure to accommodate green technology is really a vital issue'.
- Moreover, apart from the common security issues, the green security emphasizes the role of security tools, methods and practices that reduce a company's environmental impact. But to estimate the scope, to cope with the lack of green security services in the market and get advice on conserving power and purchasing switches is very important and needs a high level of sensitivity. Learning about the challenges of implementing green security and the best practices is a major hope, as the artifacts are still evolving.

15. BRING YOUR OWN DEVICE (BYOD):

- **BYOD (Bring Your Own Device)** refers to business policy that allows employees to use their preferred computing devices, like smart phones and laptops for business purposes.
- It means employees are welcome to use personal devices (laptops, smart phones, tablets etc.) to connect to the corporate network to access information and application.
- The BYOD policy has rendered the workspaces flexible, empowering employees to be mobile and giving them the right to work beyond their required hours.
- Though it has led to an increase in employees' satisfaction but also reduced IT desktop costs for organizations as employees are willing to buy, maintain and update devices in return for a one-time investment cost to be paid by the organization.
- In the early 1990s, executing different tasks necessitated the use of different devices. However, remarkable advances in technology in the last decade have made it possible to perform all the tasks using a single hi-tech device. Different technologies can work in synergy with each other, which improves user productivity and convenience.

ADVANTAGES OF BYOD:

- **Happy Employees:** Employees love to use their own devices when at work. This also reduces the number of devices an employee has to carry; otherwise he would be carrying his personal as well as organization provided devices.
- **Lower IT budgets:** The employees could involve financial savings to the organization since employees would be using the devices they already possess, thus reducing the outlay of the organization in providing devices to them.
- **IT reduces support requirement:** IT department does not have to provide end user support and maintenance for all these devices resulting in cost savings.
- **Early adoption of new Technologies:** Employees are generally proactive in adoption of new technologies that result in enhanced productivity of employees leading to overall growth of business.
- **Increased employee efficiency:** The efficiency of employees is more when the employee works on his/her own device. In an organization provided devices, employees have to learn and there is a learning curve involved in it.

16. EMERGING BYOD THREATS:

Every business decision is accompanied with a set of threats and so is BYOD program too. Overall, these risks can be classified into four areas as outlined below:

- **Network Risks:**
It is normally exemplified and hidden in 'Lack of Device Visibility'. When company-owned devices are used by all employees within an organization, the organization's IT practice has complete visibility of the devices connected to the network. As BYOD permits employees to carry their own devices (smart phones, laptops for business use), the IT practice team is unaware about the number of devices being connected to the network. As network visibility is of high importance, this lack of visibility can be hazardous. For example, if a virus hits the network and all the devices connected to the network need to be scanned, it is probable that some of the devices would miss out on this routine scan operation.
- **Device Risks:**
It is normally exemplified and hidden in 'Loss of Devices'. A lost or stolen device can result in an enormous financial and reputational embarrassment to an organization as the device may hold sensitive corporate information. Data lost from stolen or lost devices ranks as the top security threats as per the rankings released by Cloud Security Alliance. With easy access to company emails as well as corporate intranet, company trade secrets can be easily retrieved from a misplaced device.
- **Application Risks:**
It is normally exemplified and hidden in 'Application Viruses and Malware'. A related report revealed that a majority of employees' phones and smart devices that were connected to the corporate network weren't protected by security software. With an increase in mobile usage, mobile vulnerabilities have increased concurrently. Organizations are not clear in deciding that 'who is responsible for device security – the organization or the user'.
- **Implementation Risks:**
It is normally exemplified and hidden in 'Weak BYOD Policy'. The effective implementation of the BYOD program should not only cover the technical issues mentioned above but also mandate the development of a robust implementation policy. Because corporate knowledge and data are key assets of an organization, the absence of a strong BYOD policy would fail to communicate employee expectations, thereby increasing the chances of device misuse. In addition to this, a weak policy fails to educate the user, thereby increasing vulnerability to the above mentioned threats.

17. MOBILE COMPUTING AND BYOD:

Mobile computing, including BYOD is the **single most radical shift** in business since the PC revolution of the 1980s. Over the next decade, it will have a **huge impact** on how people work and live, how companies operate, and on the IT infrastructure.

These services will focus on the issues and opportunities surrounding the new way to communicate and consume computing services.

Mobile computing is not just PCs on the move. Mobile devices such as smart phones, tablets, and the iPod Touch, the last PDA standing are a radically different kind of devices, rather than primarily as stand-alone devices.

They are optimized for mobility, which means that they have to be light, easy to handle, and maximize battery life. Where laptops have a three hour battery life, the tablet and smartphone regularly run 12 hours or more between charging and serve as windows into the Cloud.

18. SOCIAL MEDIA:

- When we hear the word **network**, we imagine a set of entities connected with each other on a logical or a physical basis.
- Social networks are comprised of the most intelligent components- human beings & due to the various facets of the human species, we can have multiple types of social networks in all the fields and areas. This can range from a network of researchers, to a network of doctors to a network of academics.
- Each type of network has its own focus area, member size, geographical spread, societal impact and objective. Managing such networks is not only complicated but requires lot of collective efforts and collaboration.
- A social network is usually created by a group of individuals, who have a set of common interests and objectives. After the minimum numbers are met, the network starts its basic operations and goes out to achieve its goal.
- Success of a social network mainly depends on contribution, interest and motivation of its members along with technology backbone or platform support that makes the life easier to communicate and exchange information to fulfill a particular communication need.
- Implementing social networks and sustaining them is one of the biggest challenges and people have formulated many mechanisms in the past to keep alive such networks. This has been largely supported by the advancements in the field of IT. Web 2.0 has been one of the greatest contributors in this area and it has been a great contributor in the era called 'technology diminishing the humane distance'.

19. WEB 2.0:

- Web 2.0 is the term given to describe a second generation of the World Wide Web that is focused on the ability for people to collaborate and share information online.
- This refers to the transition from static HTML Web pages to a more dynamic Web that is more organized and is based on serving Web applications to users.
- Other improved functionality of Web 2.0 includes open communication with an emphasis on Web-based communities of users, and more open sharing of information.
- The main agenda of Web 2.0 is to connect people in numerous new ways and utilize their collective strengths, in a collaborative manner. In this regard, many new concepts have been created such as Blogging, Social Networking, Communities, Mash-ups, and Tagging.
- *The two major contributors of Web 2.0 are the technological advances enabled by **Ajax (Asynchronous JavaScript and XML)** and other applications and other applications such as **RSS (Really Simple Syndication)** and **Eclipse** that support the user interaction and their empowerment in dealing with the web.*
- *One of the most significant differences between Web 2.0 and the traditional World Wide Web (referred as Web 1.0) is that Web 2.0 facilitates greater collaboration and information sharing among Internet users, content providers and enterprises. Thus it can be said that the migration is from the "read-only web" to "read-write web".*

20. COMPONENTS OF WEB 2.0 FOR SOCIAL NETWORKS:

Major components that have been considered in Web 2.0 include the following:

- **Communities:** These are an online space formed by a group of individuals to share their thoughts, ideas and have a variety of tools to promote Social Networking. There are a number of tools available online, now-a-days to create communities, which are very cost efficient as well as easy to use.
- **Blogging:** *A blog is a journal, diary, or a personal website that is maintained on the internet, and it is updated frequently by the user. Blogging allows a user to make a post to a web log or a blog. Blogs give the users of a Social Network the freedom to express their thoughts in a free form basis and help in generation and discussion of topics.*
- **Wiki:** A Wiki is a set of co-related pages on a particular subject and allow users to share content. Wikis replace the complex document management systems and are very easy to create and maintain.
- **Mash-ups:** This is the facility, by using which people on the internet can congregate services from multiple vendors to create a completely new service. An example may be combining the location information from a mobile service provider and the map facility of Google maps in order to find the exact information of a cell phone device from the internet, just by entering the cell number.
- **Folksonomy/tagging:** *This allows the free classification of information available on the web, which helps the users to classify and find information, using approaches such as tagging. Also known as Social Bookmarking, the bookmarks in a folder are not stored on the user's computer rather tagged pages are stored on the web increasing the accessibility from any computer connected to the Internet.*
- **File Sharing/Podcasting:** This is the facility, which helps users to send their media files and related content online for other people of the network to see and contribute
- **RSS-generated Syndication:** *RSS is a format for syndicating web content that allows feed the freshly published web content to the users through the RSS reader.*
- **Usage of Ajax and other new technologies:** *Ajax is a way of developing web applications that combines XHTML and CSS (Cascading Style Sheets) standards- based presentation that allows the interaction with the web page and data interchange with XML (eXtensible Markup Language) and XSLT (eXtensible Stylesheet Language Transformations).*

21. TYPES AND BEHAVIOR OF SOCIAL NETWORKS:

The nature of social networks makes its variety. We have various types of social networks based on needs and goals. Compartmentalizing social networks is quite a challenging activity. Social networks exist in various domains-within and outside organizations, within and outside geographical boundaries, within and outside social boundaries and many other areas. Such huge variations make the reach of social networks grow to all sectors of the society. Keeping these in mind, the main categories identified are given below:

Social Contact Networks: These types of networks are formed to keep contact with friends and family. These have become the most popular sites on the network today. They have all components of Web 2.0 like blogging, tagging, wikis, and forums. Examples of these include Orkut, Facebook and Twitter.

Study Circles: These are social networks dedicated for students, where they can have areas dedicated to student study topics, placement related queries and advanced research opportunity gathering. These have components like blogging and file sharing. Examples of these include, Fledge Wing and College Tonight.

Social Networks for Specialist Groups: These types of social networks are specifically designed for core field workers like doctors, scientists, engineers, members of the corporate industries. A very good example for this type of network is LinkedIn.

Networks for Fine Arts: These types of social networks are dedicated to people linked with music, painting and related arts and have lots of useful networking information for all aspiring people of the same line.

Police and Military Networks: These types of networks, though not on a public domain, operate much like social networks on a private domain due to the confidentiality of information.

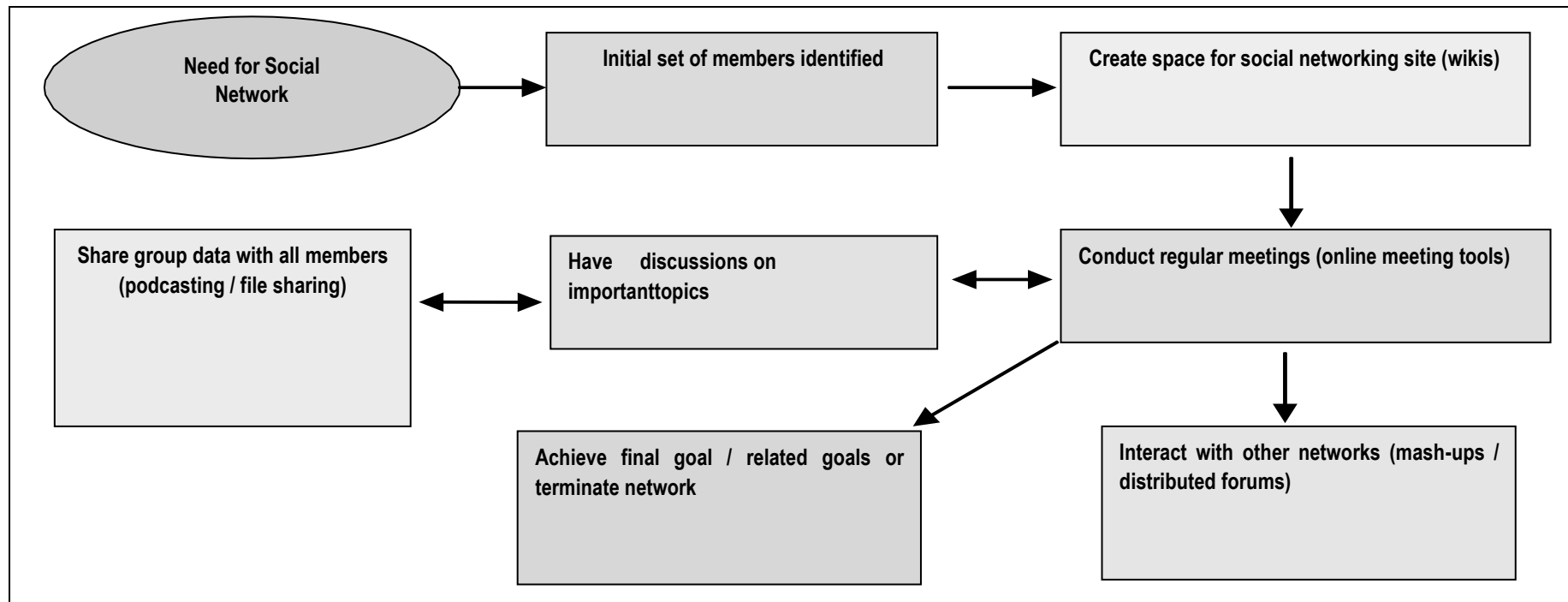
Sporting Networks: These types of social networks are dedicated to people of the sporting fraternity and have a gamut of information related to this field. Examples of these include Athlinks.

Mixed Networks: There are a number of social networks that have a subscription of people from all the above groups and is a heterogeneous social network serving multiple types of social collaboration.

Social Networks for the 'inventors': These are the social networks for the people who have invented the concept of social networks, the very developers and architects that have developed the social networks. Examples include Technical Forums and Mash-up centres.

Shopping and Utility Service Networks: The present world of huge consumerism has triggered people to invest in social networks, which will try to analyze the social behaviour and send related information for the same to respective markets and stores.

22. LIFE CYCLE OF SOCIAL NETWORKS:



Applications of Web 2.0

- Implementations of social networks using Web 2.0 have already had a Tremendous effect on society as a whole.
- One of the most important groups of people - the medical community already has reaped significant benefits from the technology and is translating this towards the betterment of public life. According to a survey conducted by a website, almost "89% of physicians use at least one Web 2.0 tool in their medical practice".
- This has also helped NGO's and other social service organizations to create meaningful social networks to reach out to people in a much more structured manner and in turn benefit the needy and deprived sector of the society.
- Social networks built on Web 2.0 concepts has become so cost affordable and easy to use that more and more people are migrating to this wave.

Web 2.0 finds applications in different fields, some of which are as follows:

Social Media: Social Media/Social Network is an important application of web 2.0 as it provides a fundamental shift in the way people communicate and share information. The social web offers a number of online tools and platforms that could be used by the users to share their data, perspectives, and opinions among other user communities.

Marketing: Web 2.0 offers excellent opportunities for marketing by engaging customers in various stages of the product development cycle. It allows the marketers to collaborate with consumers on various aspects such as product development, service enhancement, and promotion. Consumer-oriented companies use networks such as Twitter and Facebook as common elements of multichannel promotion of their products.

Education: Web 2.0 technologies can help the education scenario by providing students and faculty with more opportunities to interact and collaborate with their peers. By utilizing the tools of Web 2.0, the students get the opportunity to share what they learn with other peers by collaborating with them.

23. Benefits and Challenges for Social Networks using Web 2.0:

BENEFITS:

- It provides a platform where users of the network need not to worry about the implementation or underlying technology at a very affordable cost and a very easy pickup time.
- Concepts of Web 2.0 like blogging are some things that people do on a day-to-day basis and no new knowledge skills are required.
- Web 2.0 techniques are very people centric activities and thus, adaptation is very fast.
- People are coming much closer to another and all social and geographical boundaries are being reduced at lightning speed, which is one of the biggest sustenance factors for any social network.
- Using Web 2.0 also increases the social collaboration to a very high degree and this in turn helps in achieving the goals for a social network.

CHALLENGES:

- Data security
- Data privacy
- Data leak
- Data confidentiality
- Privacy of individual users also arises and can create a huge problem if malicious users somehow manage to perpetuate the social networks.
- A majority of the social networks are offline, and for bringing these under the purview of online social networks, a lot of education and advertising needs to be done, which itself becomes a cost burden, when the people involved are not computer literate.

24. WEB 3.0:

- The term Web 3.0, also known as the Semantic Web, describes sites wherein the computers will be generate raw data on their own without direct user interaction.
- Web3.0 is considered as the next logical step in the evolution of the Internet and Web technologies.
- For Web 1.0 and Web 2.0; the Internet is confined within the physical walls of the computer, but as more and more devices such as smartphones, cars and other household appliances become connected to the web, the Internet will be omnipresent and could be utilized in the most efficient manner.
- Web 2.0 technologies allows the use of read/write web, blogs, interactive web applications, rich media, tagging or folksonomy while sharing content, and also social networking sites focusing on communities. At the same time, Web 3.0 standard uses semantic web technology, drag and drop mash-ups, widgets, user behavior, user engagement, and consolidation of dynamic web contents depending on the interest of the individual users.
- Web 3.0 technology uses the “Data Web” Technology, which features the data records that are publishable and reusable on the web through query- able formats. The Web 3.0 standard also incorporates the latest researches in the field of artificial intelligence.
- An example of typical Web 3.0 application is the one that uses content management systems along with artificial intelligence. These systems are capable of answering the questions posed by the users, because the application is able to think on its own and find the most probable answer, depending on the context, to the query submitted by the user. In this way, Web 3.0 can also be described as a “machine to user” standard in the internet.

The two major components of Web 3.0 are as follows:

Semantic Web:

This provides the web user a common framework that could be used to share and reuse the data across various applications, enterprises, and community boundaries. This allows the data and information to be readily intercepted by machines, so that the machines are able to take contextual decisions on their own by finding, combining and acting upon relevant information on the web.

Web Services:

It is a software system that supports computer-to-computer interaction over the Internet. For example - the popular photo-sharing website Flickr provides a web service that could be utilized and the developers to programmatically interface with Flickr in order to search for images.

To conclude, Web 3.0 helps to achieve a more connected open and intelligent web applications using the concepts of natural language processing machine learning, machine reasoning and autonomous agents